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REMARKS

Claim Rejections – 35 USC § 103

Examiner rejects Claims 1,3,9,11,13,15,17 under 35 U.S.C.
103(a) as being unpatentable over Young et al. in view of Denov

5   et al.

Specifically, examiner states that "Young et al. . . .
discloses all features claimed, but does not explicitly disclose
exclusive-OR comparing. Denov et al. disclose a tuning device
similar to applicants' invention, which comprises exclusive-OR

10   gates 146,170 for signal comparison. It would have been obvious
to adapt the Young teachings with those of Denov, as exclusive-OR
comparing is functionally equivalent to the signal comparing
utilized by Young." (emphasis added) This rejection cannot be
sustained, for several reasons.

15   First, the exclusive-OR (XOR) gates **146** and **170** used in
Denov generate a pulse each time the square wave output signal
from divide circuit **140** either rises or falls. These exclusive-
OR gates have *nothing whatsoever* to do with the vibration sensing
or signal comparison taking place in Denov's vibration sensor **16**

20   (column 12, lines 30-68), and they are *not* "functionally
equivalent to the signal comparing utilized by Young." Secondly,
Denov's vibration sensor **16** makes no use whatsoever of any
exclusive-OR gating but rather makes use of a "pair of
photoresistors **30** and **32**" which "form two arms of a conventional

25   bridge circuit" (column 4, lines 11 and 18-19). Third, given the
fact that Denov is expressly aware of and cleverly employs
exclusive-OR gates elsewhere in his system for rise/fall

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detection but does *not* employ exclusive-OR gates for vibration

sensing even though this would be possible based on applicants'

novel and nonobvious disclosure, *Denov is in fact teaching away*

from using exclusive-OR comparison for vibration sensing.

5   The upshot is that examiner has found exclusive-OR gates

used *somewhere* in Denov's system though *not* used for vibration

sensing, has also found also vibration sensors in both Denov and

Young neither of which use exclusive-OR gates, and has concluded

that the existence of exclusive-OR gates *somewhere* in Denov -

10   although totally unrelated to the vibration sensing - renders it

obvious to employ exclusive-OR comparison as a functional

equivalent of Young's 8751 Single-Chip Microcomputer. This

conclusion is reached without the slightest hint or suggestion

anywhere in Young or Denov that an exclusive-OR comparison might

15   be employed for vibration sensing itself, and without any

teaching whatsoever about *how* to use an exclusive-OR comparison

for vibration sensing even if one were inclined to do so in the

first place.

In sum, examiner erroneously holds, because Young and Denov

20   do vibration sensing by means other than exclusive-OR comparing,

and because Denov uses exclusive-OR gates elsewhere in a part of

his system unrelated to vibration sensing, that 1) it would be

obvious to use an exclusive-OR gate for vibration sensing itself

and 2) it would be obvious *how* to use this exclusive-OR gate for

25   vibration sensing. There is no teaching in the art of record to

support this.

We now examine this in further detail. First, we will

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review the pertinent features of applicants' disclosure as set

forth in claim 1; then we will examine what Denov actually

teaches in relation to applicants' claim 1.

       Applicants' claim 1 recites, in pertinent part, "generating

5   a comparison signal (214) by exclusive-OR comparing (210) a

reflected signal (202) . . . with a reference signal (206) . . .;

and extracting a representation signal (216) by passing through

from said comparison signal (214), frequencies lower than a low

pass threshold (212)."

10   As set forth clearly by applicants' disclosure particularly

in Figure 5 and the associated discussion of paragraphs 26 and

27, the exclusive-OR comparison of reflected signal **202** with

reference signal **206** results in a comparison signal **214** in which

the highs last longer than the lows while the drumhead is toward

15   the "+" peak of its movement, and in which the lows last longer

than the highs while the drumhead is toward the "-" valley of its

movement. Thus, upon "passing through from said comparison

signal (214), frequencies lower than a low pass threshold (212),"

the representation signal **216,** which effectively *averages* the

20   highs and lows from comparison signal **214,** provides a direct

representation of the actual motion of the drumhead, thus sensing

the vibration. This is a novel and nonobvious method of using

exclusive-OR comparison in combination with low pass filtering to

detect surface vibration which is not disclosed, suggested, or

25   motivated by Young or Denov, separately or in combination.

       The function of Denov's exclusive-OR gates **146** and **170** is

spelled out clearly in column 12, lines 30-68: "Divide circuit

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140, in the present embodiment . . . produces a square wave having the same amplitude as the square wave received from operational amplifier **134,** *but having a period twice as long. . . . *The square wave produced by divide circuit **140** is then fed

5   through resistor **142** to input terminal **148** of exclusive-OR gate **146.** . . . [E]xclusive OR gate **146** will only produce a logic 1 in the form of a pulse *responsive to the leading and trailing sides of the square wave which it receives. Exclusive OR gate **146** produces a latch pulse; and the latch pulse is timed to occur at*

10 *each signal cycle received by divide circuit **140**. Likewise, exclusive-OR gate **170** functions in a similar fashion to produce a reset pulse [which] will be produced on the order of one microsecond after the latch pulse."*

Referring to Denov's Figure 6, Figure 1 below illustrates in

15 detail, the signal processing which is described above. A square wave which is input to divide circuit **140** emerges from divide circuit **140** with its amplitude unchanged, but with a "period twice as long." This signal from divide circuit **140** is then fed directly into a first input terminal **150** of exclusive-OR gate

20 **146,** and via RC integrating circuit **142, 144** into a second input terminal **148** of exclusive-OR gate **146.** This signal from divide circuit **140** is also fed via RC integrating circuit **162, 164** into a first input terminal **172** of exclusive-OR gate **170,** and via RC integrating circuit **166, 168** into a second input terminal **174** of

25 exclusive-OR gate **170.**

As stated by Denov at column 12, lines 56-68, "[t]he value of capacitances **144, 164** and **168** is, respectively, 0.001

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microfarad, 0.0022 microfarad and 0.0033 microfarad. It is

apparent that the time constants of resistance-capacitance pair

142 and **144**, resistance-capacitance pair **162** and **164**, and

resistor **166** and capacitor **168**, are different. Since the time

5   constants of the RC circuits connected to input terminals **172** and

174, respectively are different and gate **170** is an exclusive-OR

gate, a reset pulse will be produced on the order of one

microsecond after the latch pulse." Also, because of these

varying RC circuits, though not explicitly stated, the pulse

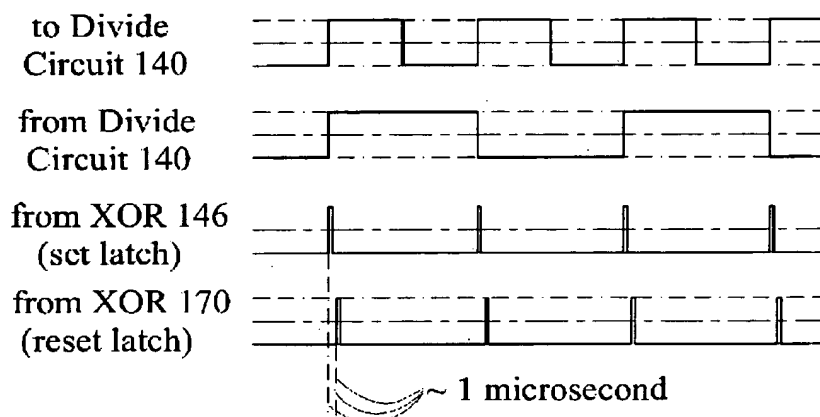10   widths themselves will be on the order of 1 microsecond.

Figure 1

In sum, because each respective capacitor **144**, **164** and **168**

15   steps up by approximately .001 microfarad, the delay introduced

by RC integrating circuit **142**, **144** relative to the direct feed

into terminal **150** produces a pulse <u>from XOR **146** (set latch)</u> with

an approximately one microsecond width and with a leading edge

coinciding with the leading edge of the pulse <u>to divide circuit</u>

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140.   The even longer delays introduced by RC integrating

circuit **162, 164** and RC integrating circuit **166, 168** produce a

similar pulse <u>from XOR **170** (reset latch)</u>, the leading edge of

which is delayed from the trailing edge of the earlier pulse by

5   approximately 1 microsecond.   These two pulses emerging from the

exclusive-OR gates are used to set and reset the latch, in

synchronization with the leading edge of the original pulse <u>to</u>

<u>divide circuit **140**</u>.   Again, this is all illustrated in Figure 1

above.

10   Contrasting this with applicants' Figure 5, it is clear that

Denov's use of exclusive-OR gating serves a very different

function than that of applicants. · Denov uses the combination of

divide circuit **140** and two exclusive-OR gates **146, 170** fed by

variable capacitance RC circuits to produce set and reset pulses

15   synchronized with square wave pulse input to divide circuit **140**.

Applicants use the combination of a single exclusive-OR

comparison feeding to low pass filtration to produce a complete

representation of the actual analog vibration of surface **13** and

thereby sense vibration.

20   Having established that Denov's exclusive-OR gates are *not*

used to sense vibrations and provide no suggestion or motivation

whatsoever in that direction, we now turn to how Denov actually

does sense vibration.

As set forth in Denov at column 11, lines 28-41 and

25   illustrated in the upper left corner of Figure 5, "*[o]ptical*

vibration sensor **16** . . *is comprised of two photoresistors* **30** *and*

32, *which are connected in a Wheatstone bridge circuit* **40**.

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Optical vibration sensor **16,** of which Wheatstone bridge circuit **40** is a part, produces a signal in response to the vibrations of drumhead **12.** The bridge signal is received by low-pass filter **54.** *Low-pass filter **54** suppresses the signal harmonics or*

5   *overtones relative to the fundamental. The filter removes signal harmonics over a one-octave range in order to prevent overtones from actuating motor **288** and detuning the kettledrum inadvertently.* The ratio between a given fundamental and its overtone is held constant over the one octave range by low-pass

10   filter **54.**"

In short, Denov detects the drumhead vibrations with an optical circuit (note that applicants use an ultrasonic signal) in which the photoresistors **30** and **32** "form two arms of a conventional bridge circuit **40**" (column 4, lines 18-19). This

15   does not in any way disclose or suggest applicants' combination of exclusive-OR comparing followed by low-pass filtering. Moreover, whereas applicants' low-pass filtering is used to *average out* the exclusive-OR comparison signal **214** to produce a direct representation of the actual surface vibration, Denov's

20   low pass filter "*removes signal harmonics* over a one-octave range in order to prevent overtones from actuating motor **288** and detuning the kettledrum inadvertently." This is a totally different purpose which does not in any way disclose or suggest or motivate applicants' claimed method of sensing vibration using

25   low pass filtering to average the output of an exclusive-OR comparison.

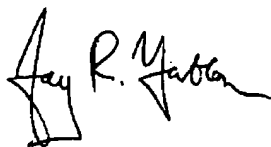Because Denov's use of exclusive-OR logic to produce set /

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reset pulses does not in any way disclose, suggest or motivate
using exclusive-OR comparison in combination with low pass
filtering to sense surface vibration *or how to do so*; because
Denov's use of two photoresistors in a bridge circuit to sense

5   drumhead vibration also does not in any way disclose, suggest or
motivate using exclusive-OR comparison in combination with low
pass filtering to sense surface vibration *or how to do so*;
because Denov's use of a low pass filter to "suppresses the
signal harmonics or overtones relative to the fundamental" does

10   not in any way disclose, suggest or motivate using low pass
filtration for averaging the output of an exclusive-OR comparison
and thereby representing actual surface vibration; and because
Young also does not disclose, suggest, or motivate any of the
foregoing, separately or in combination with Denov; the 35 USC

15   103 rejection cannot be sustained.

Conclusion

Claims 19-68 have already been allowed. As a consequence of
the foregoing, applicants respectfully request allowance of claim

20   1 and all claims dependent thereon, and look forward to receiving
a notice of allowance in the near future.

Respectfully submitted,

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